

12. (Amended) The method according to claim 11, further comprising the steps of:

decoding a code encoded in said encoding step;

generating a local pattern from a code word contained in code data decoded in said decoding step; and

combining a plurality of local patterns, which have been generated in said quantizing step, based upon position coordinates of a singularity decoded in said decoding step, and order information relating to perspective depth of a plurality of representative vectors.

REMARKS

Claims 1 to 12 are pending in the application, with Claims 1 and 8 to 12 having been amended herein. Claims 1 and 8 are the independent claims. Reconsideration and further examination are respectfully requested.

Claims 1 to 12 were rejected under 35 U.S.C. § 102 over U.S. Patent No. 5,109,451 (Aono). Reconsideration and withdrawal of this rejection are respectfully requested.

In general, the invention is related to image processing in which there is high efficiency encoding and recognition of images such that it is possible to execute asymmetric encoding that does not require the extraction of three-dimensional motion and three-dimensional structures.

Turning to specific claim language, amended independent Claim1 is directed to an image processing apparatus which includes transformation means for transforming data space of an input image to discrete multi-resolution space and outputting a discrete multi-resolution representation of the input image, detecting means for detecting a singularity in the input image, extracting means for extracting a local pattern in the neighborhood of each coordinate of the discrete multi-resolution representation of the input image, with regard to each of a plurality of depths, quantizing means for creating a quantization code book based upon the extracted local pattern and replacing each local pattern of respective depths of the discrete multi-resolution representation by a code word using the code book, and encoding means for algebraic encoding data which includes position coordinates of the singularity in the input image and the code word provided by the quantizing means.

The applied art, namely Aono, is not seen to disclose or suggest transforming the data space of the image to discrete multi-resolution space and outputting a discrete multi-resolution representation of the input image, and extracting a local pattern in the neighborhood of each coordinate of the discrete multi-resolution representation of the input image with regard to each of a plurality of depths. As such, Aono is not seen to create a quantization code book based upon the extracted local pattern and to replace each local pattern of respective depths of the discrete multi-resolution representation by a code word using the code book, wherein the code word is used to algebraically encode data.

Aono is generally seen to be directed to an orthogonal transform coding system for image data in which the image data is orthogonally transformed to spatial frequencies which are divided into low- and high-frequency domains. (Aono, abstract and

Figure 1). The system of Aono then quantizes and encodes the data in each of the high and low frequencies using different methods whereby the low-frequency data is encoded based on allocated bits in accordance with their energy levels, whereby a small number of bits are allocated to the data in the low-frequency domain. The high-frequency data is encoded by being decomposed into bit planes and performing run length coding for each bit plane.

(Aono, abstract; Figure 1; column 6, lines 49 to 58; and column 7, lines 23 to 30). The technique disclosed in Aono is seen to utilize two different techniques for low-frequency and high-frequency image data in order to perform compression of the volume of image data while attempting to avoid distortion and the introduction of artifacts into the image data. (Aono, column 7, lines 53 to 65). In addition, Aono is seen to disclose that the high-frequency data can be further quantized by using vector quantization in which the data is divided into a plurality of blocks, wherein each block is compared with predefined patterns and coding of the block is then performed using an index/code of the predefined pattern which is most similar to the given block. (Aono, column 9, lines 1 to 65). This comparison of predefined patterns to blocks of image data is only seen to be applied to high-frequency image data in Aono for achieving a desired compression. (Aono, column 10, lines 44 to 57).

In contrast, the present invention of amended independent Claim1 transforms data space of the input image to discrete multi-resolution space and outputs a discrete multi-resolution representation of the input image. This is unlike Aono, in which the image data is transformed to spatial frequency areas comprised of low- and high-frequency areas, instead of a discrete multi-resolution space. In addition, the present invention of amended independent Claim1 extracts a local pattern in the neighborhood of

each coordinate of the discrete multi-resolution representation of the input image with regard to each of a plurality of depths. The technique of Aono is not seen to perform any extraction of a local pattern, but is instead seen to divide spatial frequency data into high- and low-frequency areas and to perform different types of encoding based on the respective frequency area. Accordingly, unlike Aono, the quantization code book of the present invention is based upon an extracted local pattern and each local pattern of respective depth is replaced by a code word using the code book. In addition, the present invention algebraically encodes data including the position coordinates of a singularity of the input image and the code word which was used to replace the local pattern.

Based on the foregoing amendments and remarks, amended independent Claim 1 is believed to be in condition for allowance, and such action is respectfully requested. In addition, amended independent Claim 8 is directed to a method for image processing which substantially corresponds to the features of amended independent Claim 1. Amended independent Claim 8 is therefore believed to be in condition for allowance for the same reasons discussed above with respect to amended independent Claim 1.

The other pending claims in this application are each dependent from the independent claims discussed above and are therefore believed patentable for the same reasons. Because each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, the entire application is believed to be in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

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Respectfully submitted,


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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Amended) An image processing apparatus, comprising:

transformation means for transforming data space of an input image to discrete multi-resolution space and outputting a discrete multi-resolution representation of the input image;

detecting means for detecting a singularity in the input image;

extracting means for extracting a local pattern[, which is formed by a spatial arrangement of intensities] in the neighborhood of each coordinate of the discrete multi-resolution representation of the input image [in a partial area containing the detected singularity], with regard to each [partial areas] of a plurality of depths [sizes];

quantizing means for creating a quantization code book based upon the extracted local pattern and replacing each local pattern of respective depths of said discrete multi-resolution representation by a code word using the code book; and

encoding means for algebraic encoding [code] data which includes position coordinates of the singularity in the input image [said multi-resolution representation] and the code word provided by said quantizing means.

8. (Amended) An image processing method, comprising the steps of:

[a transformation step of] transforming data space of an input image to discrete multi-resolution space and outputting a discrete multi-resolution representation of the input image;

[a detecting step of] detecting a singularity in the input image;

[an extracting step of] extracting a local pattern[, which is formed by a spatial array of intensities] in the neighborhood of each coordinate of said discrete multi-resolution representation of the input image [in a partial area containing the detected singularity], with regard to each [partial areas] of a plurality of depths [sizes];

[a quantizing step of] creating a quantization code book based upon the extracted local pattern and replacing each local pattern of respective depths of said discrete multi-resolution representation by a code word using the code book; and

[an encoding step of] algebraically encoding [code] data which includes position coordinates of the singularity in the input image [said multi-resolution representation] and the code word obtained in [at] said creating [quantizing] step.

9. (Amended) The method according to claim 8, further comprising a [counting] step of counting frequency of occurrence of said local pattern, wherein said creating [quantizing] step creates a code book based upon results of counting obtained in [at] said counting step.

10. (Amended) The method according to claim 9, further comprising a [structuring] step of detecting an inclusion relation of any two representative vectors that have been registered in said code book, and structuring said code book.

11. (Amended) The method according to claim 9, further comprising the steps of:
[a calculating step of] calculating, in [at] said creating [quantization] step, degree of conformity or quantization error when the local pattern is allocated to a representative vector;
and

[a deciding step which, on the basis of the degree of conformity or quantization error, is for] deciding the order relating to the perspective depth between any two representative vectors contained in the code data based on the degree of conformity or quantization error,[;]

wherein said encoding step encodes the order relating to the perspective depth.

12. (Amended) The method according to claim 11, further comprising the steps of:

[a decoding step of] decoding a code encoded in [at] said encoding step;
[an inverse quantizing step of] generating a local pattern from a code word contained in code data decoded in [at] said decoding step; and

[a synthesizing step of] combining a plurality of local patterns, which have been generated in [at] said [inverse] quantizing step, based upon position coordinates of a singularity